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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/642,611	08/19/2003	Toshitaka Aoyagi	402761	2829

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LEYDIG VOIT & MAYER, LTD
700 THIRTEENTH ST. NW
SUITE 300
WASHINGTON, DC 20005-3960

EXAMINER	
VAN ROY, TOD THOMAS	

ART UNIT	PAPER NUMBER
2828	

DATE MAILED: 08/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/642,611	AOYAGI ET AL.	
	Examiner	Art Unit	
	Tod T. Van Roy	2828	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 June 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3 and 6-10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *7* is/are allowed.

6)☒ Claim(s) *1,3,6 and 8-10* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

The examiner acknowledges the amending of claim 1, and the addition of claim 10.

Response to Arguments

Applicant's arguments with respect to claim 1 have been considered but are moot in view of the new ground(s) of rejection.

The examiner hereby withdraws the previously noted allowable subject matter pertaining to the limitation "the absolute value of a real part of a coupling coefficient is at least four times the absolute value of an imaginary part of the coupling coefficient". This limitation, which pertains to claim 1, and the previous combination of claims 1 and new claim 10 is no longer believed to be allowable in its current state.

The real and imaginary values of the coupling coefficient having the limitations outlined in claim 1 are to herein be rejected based on the Abe reference. As the grating structure in Abe is only taught to be index coupled and not complex coupled (since there is no gain region modulation by the grating, no taught absorptive properties of the grating, and no current blocking of the active region by the grating, the imaginary part of the coupling coefficient would be zero) it is believed that the coupling coefficient relationship is fulfilled. As the imaginary part of the coefficient is zero, four times the real portion would then be greater than the imaginary component and hence would meet the limitation. ***The examiner suggests amending of the claim language to include the***

limitation that the grating is complex coupled (i.e. non-zero real and imaginary portions), or that the imaginary portion is non-zero.

The examiner also believes that the Lu reference is once again valid to be used in rejecting claim 1. As indicated in the Advisory action, the Lu reference was at least in part found to be un-obvious to combine due to the symmetrical nature of the device gratings (see pages 3-4, paper no. 02132006). Since the limitation stating the difference between the first and second gratings no longer exists, it is believed that the symmetrical device of Lu is once again an obvious combination to one of ordinary skill in the art.

Please see below for an updated rejection to the claims.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Abe et al. (US 5020072) in view of Lo (US 5617436).

With respect to claim 1, Abe teaches a refractive index coupling distributed feedback (DFB) semiconductor laser comprising opposed first and second end surfaces through which light generated within the semiconductor laser may be emitted (fig.4 left and right sides), a central phase shift structure located substantially centrally between the first and second end surfaces (col.9 lines 4-7), and first and second diffraction gratings respectively extending from the central phase shift structure to the first and second end faces (fig.4e), an average coupling coefficient k2 of a diffraction grating on one end face side (fig.4 right side) is smaller than an average coupling coefficient k1 of a diffraction grating on the other end face side (fig.4 left side) (col.12 lines 4-10), and the absolute value of the real part of the coupling coefficient to be at least 4 times the absolute value of the imaginary part of a coupling coefficient (only index coupled, imaginary portion is zero, please see response to arguments above). Abe does not teach the coupling coefficients to be greater than 100cm-1. Lo teaches a DFB semiconductor laser device (fig.1) in which the coupling coefficients are greater than 100cm-1 (col.4 lines 11-21). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the DFB laser of Abe with the large coupling coefficients of Lo in order to increase resonator feedback, utilizing more gain, and allow for the reduction of the laser spot size (col.4 lines 22-25).

With respect to claim 8, Abe and Lo teach the DFB device outlined in the rejection to claim 1 and further teach changing the coupling coefficients, k1 and k2, via changing a thickness of a low refractive index layer between that of the active region and the high index grating portion (fig.7, col.11 lines 49-57).

Claims 1, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Abe et al. (US 5020072) in view of Lo (US 5617436), and further in view of Lu et al. ("High Power and High Speed Performance of 1.3um Strained MQW Gain Coupled DFB Lasers," IEEE JQE, Vol.1, No.2 1995, pgs.375-381).

With respect to claim 1, Abe teaches a refractive index coupling distributed feedback (DFB) semiconductor laser comprising opposed first and second end surfaces through which light generated within the semiconductor laser may be emitted (fig.4 left and right sides), a central phase shift structure located substantially centrally between the first and second end surfaces (col.9 lines 4-7), and first and second diffraction gratings respectively extending from the central phase shift structure to the first and second end faces (fig.4e), an average coupling coefficient k2 of a diffraction grating on one end face side (fig.4 right side) is smaller than an average coupling coefficient k1 of a diffraction grating on the other end face side (fig.4 left side) (col.12 lines 4-10). Abe does not teach the absolute value of the real part of the coupling coefficient to be at least 4 times the absolute value of the imaginary part of the coupling coefficient, or the coupling coefficients to be greater than 100cm-1. Lo teaches a DFB semiconductor laser device (fig.1) in which the coupling coefficients are greater than 100cm-1 (col.4

lines 11-21). Lu teaches a complex coupled DFB laser in which a real part of a coupling coefficient is at least 4 times an imaginary part of a coupling coefficient (Fig.2, col.3 lines 22-29, where the figure and text describe utilizing real and imaginary components of ratios less than 25%). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the DFB laser of Abe with the large coupling coefficients of Lo in order to increase resonator feedback, utilizing more gain, and allow for the reduction of the laser spot size (col.4 lines 22-25), as well as to combine the DFB laser with complex coupling of Lu in order to have less sensitivity to external reflections (Lu, col.1 lines 14-20) and to provide for enhanced single mode operation (Lu, col.3 lines 24-29).

With respect to claim 8, Abe and Lo teach the DFB device outlined in the rejection to claim 1 and further teach changing the coupling coefficients, k1 and k2, via changing a thickness of a low refractive index layer between that of the active region and the high index grating portion (fig.7, col.11 lines 49-57).

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Abe et al. in view of Lo and further in view of Lu and Huang (US 6574261).

With respect to claim 3, Abe, Lu and Lo teach the DFB device outlined in the rejection to claim 1, but do not teach the device to include a plurality of phase shift structures located at substantially symmetrical positions with respect to the central phase sift portion in the diffraction gratings. Huang teaches a DFB semiconductor laser utilizing multiple phase shift structures (fig.9), located at substantially symmetrical

positions with respect to the central phase sift portion in the diffraction gratings. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the DFB laser of Abe, Lu and Lo with the multiple phase shift structures of Huang in order to uniformly distribute carriers and reduce spatial hole burning (Huang, col.12 lines 47-50).

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Abe et al. in view of Lo and further in view of Lu and Takahashi et al. (US 5727015).

With respect to claim 6, Abe, Lu and Lo teach the DFB device outlined in the rejection to claim 1, but do not teach the device to have a higher ratio of higher index material to lower index material in the k1 region than in the k2 region. Takahashi teaches DFB semiconductor laser in which the duty of the gratings is examined based on coupling coefficient values (fig.3a, in which it can be understood that a high coupling region, k1, could have a larger duty than a low coupling region, k2, this duty being defined as the length of the higher index region to the lower index region, col.1 lines 63-67, fig.1- comparing higher index #106 to lower index #108 as analyzed in fig.3a). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the DFB laser of Abe, Lu and Lo with the high to low duty values of Huang in order to appropriately couple the E-field to a desired grating region.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Abe et al. in view of Lo and further in view of Lu and Weber (US 5379318).

With respect to claim 9, Abe, Lu and Lo teach the DFB device outlined in the rejection to claim 1, but do not teach the device to satisfy the relationship that the effective index through grating2 times the period of grating2 be almost equal to the effective index of grating1 times the period of grating1. Weber teaches a semiconductor laser in which an effective index through a grating2 times the period of a grating2 be almost equal to the effective index of a grating1 times the period of a grating1 (fig.1 #G1,G3; the effective index of G3 would be greater than that of G1 due to the larger amount of high index grating material, but the period of G1 would be greater than that of G3 in order to correctly fit the relationship shown in fig.2, this leads to the approximate balancing of NeffG1*PeriodG1 almost equal to NeffG3*PeriodG3). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the DFB laser of Abe, Sato and Lo with the grating structure of Weber in order to allow for a larger degree of wavelength selectivity.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Abe et al. in view of Lo and further in view of Lu and Sato (US 6175581).

With respect to claim 10, Abe, Lu, and Lo teach the device as outlined in the rejection to claim 1, but do not teach the gratings to have different periods. Sato teaches a DFB laser in which the gratings on either side of the central phase shift region have different periods (fig.1). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the DFB laser of Abe, Lu, and Lo with the

asymmetrical diffraction gratings of Sato in order to flatten the electric field intensity distribution and increase the threshold gain difference (Sato, col.5 lines 15-20).

Allowable Subject Matter

Claim 7 allowed.

The following is a statement of reasons for the indication of allowable subject matter:

Please refer to the previous advisory action for the reasons given for allowing claim 7.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tod T. Van Roy whose telephone number is (571)272-8447. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571)272-1835. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TVR

MINSUN OH HARVEY
PRIMARY EXAMINER